## THAT WHICH IS CLAIMED:

1. A method of making an ordered array of magnetized nanorods, the method comprising:

electroforming a plurality of relatively high aspect ratio nanorods wherein each individual nanorod includes a portion electroformed of gold and a portion electroformed of nickel;

modifying the plurality of nanorods so that in each individual nanorod the gold portion is modified to become hydrophobic and the nickel portion is modified to become hydrophilic;

dispersing the plurality of modified nanorods on an interface between an aqueous phase and a non-aqueous phase so that each individual nanorod orients having the hydrophilic nickel portion in the aqueous phase extending away from the interface in a relatively perpendicular direction therefrom and having the hydrophobic gold portion in the non-aqueous phase extending away from the interface in a relatively perpendicular direction therefrom; and

self-assembling the plurality of dispersed nanorods by adjusting ionic content in the aqueous phase so as to sufficiently control repulsive forces between individual nanorods of the plurality of nanorods to thereby promote self-assembly of the plurality of nanorods into an ordered array wherein substantially all individual nanorods of the plurality are aligned generally parallel with each other along the interface.

2. The method of claim 1, wherein electroforming further comprises electroforming the plurality of nanorods within pores of a membrane filter.

3. The method of claim 1, wherein electroforming further comprises electroforming the plurality of nanorods within pores of a membrane filter, the pores having diameters ranging in size from approximately 20 to 200 nm.

4. The method of claim 1, wherein each individual nanorod of the plurality of nanorods has a cylindrical shape having a diameter of between approximately 20 and 200 nm.

5. The method of claim 1, wherein each individual nanorod of the plurality of nanorods has a cylindrical shape having a length of between approximately 1 and 10 μm.

6. The method of claim 1, wherein electroforming further comprises electroforming the plurality of nanorods within pores of a membrane filter, followed by dissolving the membrane filter so as to release the plurality of formed nanorods.

7. The method of claim 1, wherein electroforming further comprises electroforming the plurality of nanorods within pores of an alumina membrane filter.

8. The method of claim 1, wherein electroforming further comprises electroforming the plurality of nanorods within pores of an alumina membrane filter, the pores having diameters ranging in size from approximately 20 to 200 nm.

9. The method of claim 1, wherein electroforming further comprises electroforming the plurality of nanorods within pores of an alumina membrane filter, followed by dissolving the alumina membrane filter so as to release the plurality of formed nanorods.

10. The method of claim 1, wherein modifying further comprises forming a surface layer of alkanethiolate on each individual nanorod of the plurality of nanorods.

11. The method of claim 10, wherein the alkanethiolate contains octadecanethiolate.

12. The method of claim 1, wherein modifying further comprises contacting the plurality of nanorods with a composition containing octadecanethiol and ethanol so as to form a surface layer of octadecanethiolate on each individual nanorod of the plurality of nanorods.

13. The method of claim 1, wherein modifying further comprises forming a surface layer of alkanethiolate on each individual nanorod of the plurality of nanorods, followed by washing off the surface layer of alkanethiolate from the nickel portion of each individual nanorod of the plurality of nanorods.

14. The method of claim 13, wherein the alkanethiolate contains octadecanethiolate.

15. The method of claim 13, wherein modifying further comprises contacting the plurality of nanorods with a composition containing a positively charged polyelectrolyte so as to form a surface layer of the polyelectrolyte on the washed off nickel portion of each individual nanorod of the plurality of nanorods.

16. The method of claim 15, wherein the positively charged polyelectrolyte contains poly(diallyldimethylammonium chloride).

17. The method of claim 1, wherein modifying further comprises contacting the plurality of nanorods with a composition containing octadecanethiol and ethanol so as to form a surface layer of octadecanethiolate on each individual nanorod of the plurality of nanorods, followed by washing off the surface layer of octadecanethiolate from the nickel portion of each individual nanorod of the plurality of nanorods.

18. The method of claim 17, wherein modifying further comprises contacting the plurality of nanorods with a composition containing a positively charged polyelectrolyte so as to form a surface layer of the polyelectrolyte on the washed off nickel portion of each individual nanorod of the plurality of nanorods.

19. The method of claim 18 wherein the positively charged polyelectrolyte contains poly(diallyldimethylammonium chloride).

20. The method of claim 1, wherein dispersing further comprises an aqueous phase consisting of water.

21. The method of claim 1, wherein dispersing further comprises a non-aqueous phase consisting of air.

22. The method of claim 1, wherein dispersing further comprises a non-aqueous phase consisting of a water-immiscible organic solvent.

23. The method of claim 1, wherein self-assembling further comprises adjusting ionic content with at least one salt.

24. The method of claim 23, wherein the at least one salt includes sodium chloride.

25. The method of claim 1, further comprising monitoring self-assembly by microscopic observation.

26. The method of claim 1, further comprising monitoring self-assembly by analyzing a diffraction pattern generated by passing a beam of laser light through the plurality of nanorods and generally perpendicularly to the interface.

27. The method of claim 26, wherein the beam of laser light consists of blue light of approximately 400 nm.

28. The method of claim 1, wherein following self-assembling the ordered array of magnetized nanorods has an inter-nanorod spacing of between approximately 10 to 200 nm.

29. An ordered array of magnetized nanorods, said ordered array made by the method of claim 1.

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30. A method of making an ordered array of nanorods, the method comprising:

electroforming a plurality of relatively high aspect ratio nanorods wherein each individual nanorod includes a portion electroformed of a first metal and a portion electroformed of a second metal;

modifying the plurality of nanorods so that in each individual nanorod the first metal portion is modified to become hydrophobic and the second metal portion is modified to become hydrophilic;

dispersing the plurality of modified nanorods on an interface between an aqueous phase and a non-aqueous phase containing a water-immiscible polymerizable monomer so that each individual nanorod orients having the hydrophilic second metal portion in the

aqueous phase extending away from the interface in a relatively perpendicular direction therefrom and having the hydrophobic first metal portion in the non-aqueous phase extending away from the interface in a relatively perpendicular direction therefrom; and

self-assembling the plurality of dispersed nanorods by adjusting ionic content in the aqueous phase so as to sufficiently control repulsive forces between individual nanorods of the plurality of nanorods to thereby promote self-assembly of the plurality of nanorods into an ordered array wherein substantially all individual nanorods of the plurality of dispersed nanorods are aligned generally parallel with each other along the interface.

31. The method of claim 30, wherein electroforming further comprises electroforming the plurality of nanorods within pores of a membrane filter.

32. The method of claim 30, wherein electroforming further comprises electroforming the plurality of nanorods within pores of a membrane filter, the pores having diameters ranging in size from approximately 20 to 200 nm.

33. The method of claim 30, wherein each individual nanorod of the plurality of nanorods has a cylindrical shape having a diameter of between approximately 20 and 200 nm.

34. The method of claim 30, wherein each individual nanorod of the plurality of nanorods has a cylindrical shape having a length of between approximately 1 and 10 μm.

35. The method of claim 30, wherein electroforming further comprises electroforming the plurality of nanorods within pores of a membrane filter,

followed by dissolving the membrane filter so as to release the plurality of formed nanorods.

36. The method of claim 30, wherein electroforming further comprises electroforming the plurality of nanorods within pores of an alumina membrane filter.

37. The method of claim 30, wherein electroforming further comprises electroforming the plurality of nanorods within pores of an alumina membrane filter, the pores having diameters ranging in size from approximately 20 to 200 nm.

38. The method of claim 30, wherein electroforming further comprises electroforming the plurality of nanorods within pores of an alumina membrane filter, followed by dissolving the alumina membrane filter so as to release the plurality of formed nanorods.

39. The method of claim 30, wherein modifying further comprises forming a surface layer of alkanethiolate on each individual nanorod of the plurality of nanorods.

40. The method of claim 39, wherein the alkanethiolate contains octadecanethiolate.

41. The method of claim 30, wherein modifying further comprises contacting the plurality of nanorods with a composition containing octadecanethiol and ethanol so as to form a surface layer of octadecanethiolate on each individual nanorod of the plurality of nanorods.

42. The method of claim 30, wherein modifying further comprises forming a surface layer of alkanethiolate on each individual nanorod of the plurality of nanorods, followed by washing off the surface layer of alkanethiolate from the second metal portion of each individual nanorod of the plurality of nanorods.

43. The method of claim 42, wherein the alkanethiolate contains octadecanethiolate.

44. The method of claim 42, wherein modifying further comprises contacting the plurality of nanorods with a composition containing a positively charged polyelectrolyte so as to form a surface layer of the polyelectrolyte on the washed off second metal portion of each individual nanorod of the plurality of nanorods.

45. The method of claim 44, wherein the positively charged polyelectrolyte contains poly(diallyldimethylammonium chloride).

46. The method of claim 30, wherein modifying further comprises contacting the plurality of nanorods with a composition containing octadecanethiol and ethanol so as to form a surface layer of octadecanethiolate on each individual nanorod of the plurality of nanorods, followed by washing off the surface layer of octadecanethiolate from the second metal portion of each individual nanorod of the plurality of nanorods.

47. The method of claim 46, wherein modifying further comprises contacting the plurality of nanorods with a composition containing a positively charged polyelectrolyte so as to form a surface layer of the polyelectrolyte on the washed off second metal portion of each individual nanorod of the plurality of nanorods.

48. The method of claim 47, wherein the positively charged polyelectrolyte contains poly(diallyldimethylammonium chloride).

49. The method of claim 30, wherein dispersing further comprises an aqueous phase consisting of water.

50. The method of claim 30, wherein dispersing further comprises a non-aqueous phase consisting of air.

51. The method of claim 30, wherein dispersing further comprises a non-aqueous phase consisting of a water-immiscible organic solvent.

52. The method of claim 30, wherein self-assembling further comprises adjusting ionic content with at least one salt.

53. The method of claim 52, wherein the at least one salt includes sodium chloride.

54. The method of claim 30, further comprising monitoring self-assembly by microscopic observation.

55. The method of claim 30, further comprising monitoring self-assembly by analyzing a diffraction pattern generated by passing a beam of laser light through the plurality of nanorods and generally perpendicularly to the interface.

56. The method of claim 55, wherein the beam of laser light consists of blue light of approximately 400 nm.

57. The method of claim 30, wherein following self-assembling the ordered array of magnetized nanorods has an inter-nanorod spacing of between approximately 10 to 200 nm.

58. The method of claim 30, wherein the polymerizable monomer comprises methyl methacrylate.

59. The method of claim 30, further comprising polymerizing the polymerizable monomer following self-assembling.

60. The method of claim 30, further comprising polymerizing the polymerizable monomer by addition of an effective azo initiator following self-assembling .

61. The method of claim 30, wherein said first metal and said second metal are different metals, said first metal being selected from gold, silver, copper, chromium, and platinum, and said second metal being selected from nickel, cobalt, iron, chromium, alloys thereof, and a platinum alloy.

62. An ordered array of magnetized nanorods, said ordered array comprising:

a plurality of metallic nanorods generally cylindrical in shape and including a nickel portion coated with a positively charged polyelectrolyte and a gold portion coated with an alkanethiolate; and

a layer of a hardened polymer wherein each individual nanorod of the plurality is held by having said gold portion embedded therein so that the nickel portion extends approximately perpendicularly away from the layer of hardened polymer, and wherein said plurality of metallic nanorods is ordered in the array by having substantially all

individual nanorods of the plurality of nanorods oriented approximately parallel to each other.

63. The ordered array of claim 62, wherein each individual nanorod of the plurality of nanorods has a length of between approximately 1 and 10 μm.

64. The ordered array of claim 62, wherein each individual nanorod of the plurality of nanorods has a diameter of between approximately 20 to 200 nm.

65. The ordered array of claim 62, wherein each individual nanorod of the plurality of nanorods has a length of between approximately 1 and 10 μm and a diameter of between approximately 20 to 200 nm.

66. The ordered array of claim 62, further comprising an inter-nanorod spacing of between approximately 10 to 200 nm.

67. An ordered array of nanorods, said ordered array comprising:

a plurality of metallic nanorods generally cylindrical in shape and including a first metal portion coated with a positively charged polyelectrolyte and a second metal portion coated with an alkanethiolate; and

a layer of a hardened polymer wherein each individual nanorod of the plurality is held by having said second metal portion embedded therein so that the first metal portion extends approximately perpendicularly away from the layer of hardened polymer, and wherein said plurality of metallic nanorods is ordered in the array by having substantially all individual nanorods of the plurality of nanorods oriented approximately parallel to each other.

68. The ordered array of claim 67, wherein each individual nanorod of the plurality of nanorods has a length of between approximately 1 and 10 μm.

69. The ordered array of claim 67, wherein each individual nanorod of the plurality of nanorods has a diameter of between approximately 20 to 200 nm.

70. The ordered array of claim 67, wherein each individual nanorod of the plurality of nanorods has a length of between approximately 1 and 10 μm and a diameter of between approximately 20 to 200 nm.

71. The ordered array of claim 67, further comprising an inter-nanorod spacing of between approximately 10 to 200 nm.

72. The ordered array of claim 67, wherein said first metal consists of nickel and wherein said second metal consists of gold.

73. The ordered array of claim 67, wherein said first metal is selected from nickel, cobalt, iron, chromium, and alloys thereof.

74. The ordered array of claim 67, wherein said second metal is selected from gold, silver, copper, chromium, platinum, and alloys thereof.

75. The ordered array of claim 67, wherein said first metal comprises an alloy of platinum.

76. The ordered array of claim 67, wherein said first metal and said second metal are different metals, said first metal being selected from gold, silver, copper, chromium, and platinum, and said second metal being selected from nickel, cobalt, iron, chromium, alloys thereof, and a platinum alloy.